DESIGN NOTES

Ultralow Power Boost Converters Require Only 8.5µA of Standby Quiescent Current

Design Note 465

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Introduction

Industrial remote monitoring systems and keep-alive circuits spend most of their time in standby mode. Many of these systems also depend on battery power, so power supply efficiency in standby state is very important to maximize battery life. The LT®8410/-1 high efficiency boost converter is ideal for these systems, requiring only 8.5µA of quiescent current in standby mode. The device integrates high value (12.4M/0.4M) output feedback resistors, significantly reducing input current when the output is in regulation with no load. Other features include an integrated 40V switch and Schottky diode, output disconnect with current limit, built in soft-start, overvoltage protection and a wide input range, all in a tiny 8-pin 2mm × 2mm DFN package.

Application Example

Figure 1 details the LT8410 boost converter generating a 16V output from a 2.5V-to-16V input source. The LT8410/-1 controls power delivery by varying both the peak inductor current and switch off time. This control scheme results in low output voltage ripple as well as high efficiency over a wide load range. Figures 2 and 3 show efficiency and output peak-to-peak ripple for Figure 1's circuit. Output ripple voltage is less than 10mV despite the circuit's small (0.1µF) output capacitor.

The soft-start feature is implemented by connecting an external capacitor to the V_{REF} pin. If soft-start is not needed, the capacitor can be removed. Output voltage is set by a resistor divider from the V_{REF} pin to ground with the center tap connected to the FBP pin, as shown in Figure 1. The FBP pin can also be biased directly by an external reference.

The $\overline{SHDN}$ pin of the LT8410/-1 can serve as an on/off switch or as an undervoltage lockout via a simple resistor divider from V_{CC} to ground.

Ultralow Quiescent Current Boost Converter with Output Disconnect

Low quiescent current in standby mode and high value integrated feedback resistors allow the LT8410/-1 to regulate a 16V output at no load from a 3.6V input with

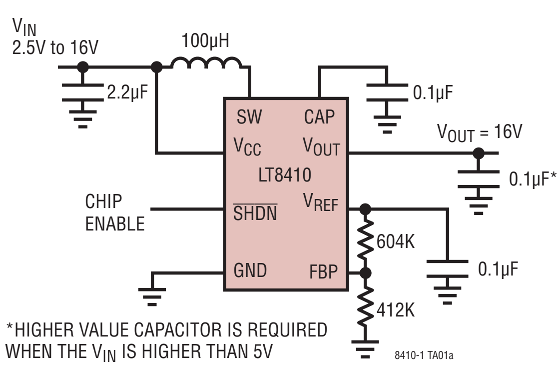

Figure 1. 2.5V-16V To 16V Boost Converter

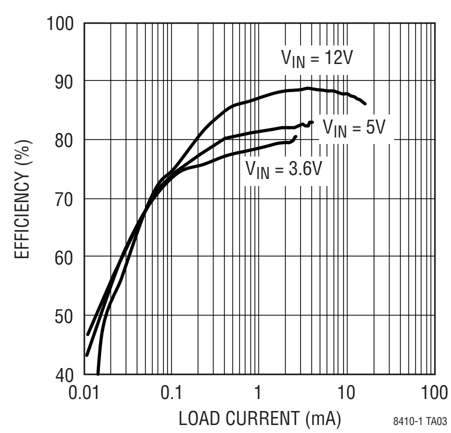

Figure 2. Efficiency vs Load Current For Figure 1 Converter

about 30μA of average input current. Figures 4, 5 and 6 show typical quiescent and input currents in regulation with no load.

The device also integrates an output disconnect PMOS, which blocks the output load from the input during shutdown. The maximum current through the PMOS is limited by circuitry inside the chip, allowing it to survive output shorts.

Compatible with High Impedance Batteries

A power source with high internal impedance, such as a coin cell battery, may show normal output on a voltmeter, but its voltage can collapse under heavy current demands. This makes it incompatible with high current DC/DC converters. With very low switch current limits (25mA for the LT8410 and 8mA for the LT8410-1), the LT8410/-1 can operate very efficiently from high impedance sources without causing inrush current problems. This feature also helps preserve battery life.

Conclusion

The LT8410/-1 is a smart choice for applications which require low standby quiescent current and/or require low input current, and is especially suited for power supplies with high impedance sources. The ultralow quiescent current and high value integrated feedback resistors keep average input current very low, significantly extending battery operating time. The LT8410/-1 is packed with features without compromising performance or ease of use and is available in a tiny 8-pin 2mm × 2mm package.

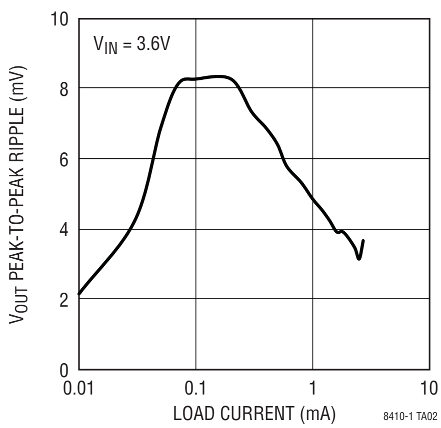

Figure 3. Output Peak-to-Peak Ripple vs Load Current for Figure 1 Converter at 3.6V

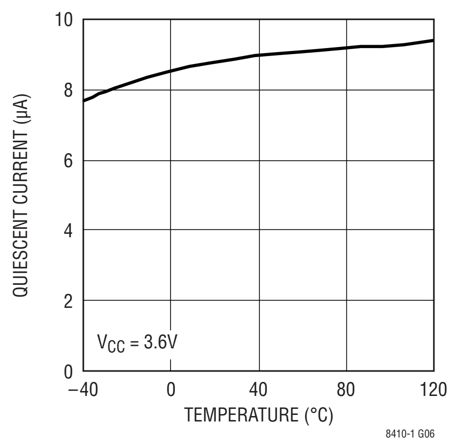

Figure 4. Quiescent Current vs Temperature (Not Switching)

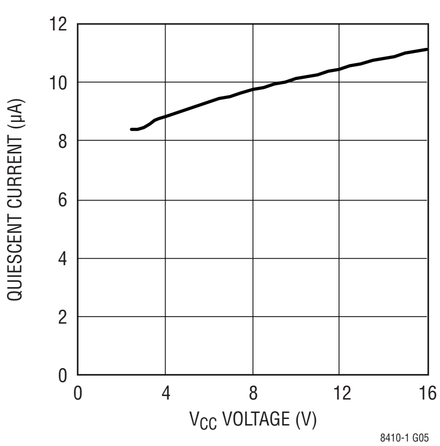

Figure 5. Quiescent Current vs V_{CC} Voltage (Not Switching)

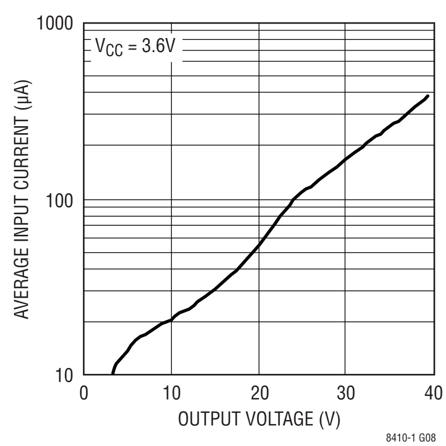

Figure 6. Average Input Current in Regulation with No Load

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